The Effects of Cold-Stored Platelets on Hemorrhagic Patients: A Meta-Narrative Review

Cynthia Medina*, Vivian Nguyen*, Kim Pham*, Pham Vu*, Mary Coolbaugh-Murphy, Ph.D., MB(ASCP)CM, Denise M. Jurosek Short, Ph.D., MB(ASCP)CM
Clinical Laboratory Science Program, School of Health Professions, UT MD Anderson Cancer Center

* Authors contributed equally and are listed in alphabetical order

Introduction
Platelet transfusions became prevalent in the 1960s when they started being used as an alternative to whole blood transfusions. They are commonly used to treat patients with thrombocytopenia, platelet disorders, and actively bleeding patients. Room temperature platelets (21-24 °C) have a 7-day shelf life, while cold-stored platelets (1-6 °C) have a 14-day shelf life (Center, 2023). Room temperature platelets (RTP) have a better hemostatic activity than cold-stored platelets (CSP) post transfusion, however, cold storage platelets can be stored for longer use, there’s a reduction in bacterial growth, and a reduced risk of transfusion reactions. Despite this, the use of CSP were quickly abandoned soon after due to the platelet’s short circulation time in the blood after transfusion (Mack, 2020). Although the platelets were absent 24 hours after transfusion, this makes it optimal for emergency use (George, 2023). The peak interest for CSP re-emerged due to them being accessible and having a longer shelf life, making it easier to transfuse in actively bleeding cases. Currently, the FDA has approved it for use in active bleeding cases to maintain levels of platelet inventory. Research on CSP has compared the advantages of CSP to RTP to provide a solution to the on-going platelet inventory shortage problem. The research has a positive effect to see if CSPs could possibly be used in platelet transfusions and RTPs for therapeutic purposes.

Methodology
A systematic search was done through screening by MD Anderson Research Library database and PubMed Database. The inclusion criteria included search terms: "cold-stored platelets + bleeding", "hemorrhage + cold-stored platelets", and "cold-stored platelets in trauma". The last day of research was February 17, 2024, and this included studies from 2019 – 2024.

Figure 2. Flow Diagram of Selecting Articles

Note: Journal articles were screened through MD Anderson Research Library database and PubMed database with keywords related to the methodology. Articles only included primary articles with specific date ranges after the abstract screening and full-text eligibility, ending up with 11 eligible studies for a full meta-review analysis.

Key Findings

- The review provides insights into the uses and effects of cold-stored platelets (CSP) through detailed experimental design and thorough evaluation.
- The review also examines storage methods which directly enhances our understanding of how well CSP maintains platelet adaptability.
- The review also examines how effective cold-stored platelets are in managing thrombocytopenia, platelet disorders, and actively bleeding patients. Room temperature platelets are the most favorable when it comes to prophylactic treatments.
- Cold-stored platelets can provide a temporary solution to help with clotting factors in bleeding patients.

Future Directions

Many of the studies experimented with CSP and RTP in vitro, providing evidence of how platelets react in the lab. With the passing of the FDA’s approval of CSP, it is recommended to continue research on the effects of both types of platelets in vivo, studying pre and post transfusion data from human patients.

The goal is for the FDA to be able to extend their threshold of a maximum of 5 days storage of cold-stored platelets.

Conclusions
As of June 2023, the FDA has only approved storage of platelets for up to 3 days at 1-6 °C for hemmorhage use and up to 14 days at 1-6 °C for military use. For emergent platelet use, findings from the 11 primary studies showed that there is improved hemostasis and platelet aggregation within one-hour post-transfusion comparable to RTP. Although studies have shown that CSP are still functionally active at the 21-day mark, their hemostatic activity and platelet survival only lasts a few hours after transfusion (Braathen, 2022). Platelets that were delayed in cold storage showed no significant changes in platelet activation and were able to function comparable to CSP.

References